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# Materials and Manufacturing Directorate: supporting past, present and future warfighters

***Reported by Materials and Manufacturing Directorate***

*WRIGHT-PATTERSON AFB, OHIO* — Ever since the Wright brothers defied the skeptics of powered flight almost 100 years ago, man has sought to make a better "flying machine."

For more than 82 years, the men and women of Air Force Research Laboratory's Materials and Manufacturing Directorate and their predecessors have been in the thick of that search. While the Directorate today looks vastly different than it did in the beginning, one thing remains unchanged — the dedication of its talented workforce to provide the best materials and manufacturing technologies for the best Air Force in the world. Their long legacy of achievements, which started with the development of plywood, continues unabated headed into the 21st century.

In 1997, a major reorganization of the Air Force science and technology program combined four separate laboratories into a single laboratory — the Air Force Research Laboratory. During this reorganization the Materials Directorate and the Manufacturing Technology Directorate of the former Wright Laboratory combined to form the Materials and Manufacturing Directorate. Also joining the new directorate was the Environics Directorate of the former Armstrong Laboratory and the Airbase Structures Branch of the former Civil Engineering Services Center, both at Tyndall AFB, Fla. Together they form the Airbase and Environmental Technology Division of the new Materials and Manufacturing Directorate. They seek new, environmentally friendly processes for advanced materials and materials to support Air Force Base infrastructures.

The Materials and Manufacturing Directorate's mission is to help keep the Air Force the best in the world. Built upon a heritage of proven successes, the Materials and Manufacturing Directorate remains dedicated to meeting the challenges that the Air Force faces, both now and in the future.

Its strong in-house basic research team is providing cutting edge research that will lead to materials for the 21st Century Air Force. Additionally, in-house researchers involved in exploratory and advanced development projects provide leadership to guide contractual research with industry and universities. They also guide the transition between research and application. Current research emphasis is on thermal protection materials, metallic and nonmetallic structural materials, nondestructive inspection methods, materials used in aerospace propulsion systems, electromagnetic and electronic materials, laser hardened materials, materials process design techniques, environmental protection technologies, and airbase infrastructures.

*KEEPING AN EYE ON THINGS — Charles Buynak, of the Materials and Manufacturing Directorate monitors a nondestructive ultrasonic inspection of a titanium aircraft engine disk.*

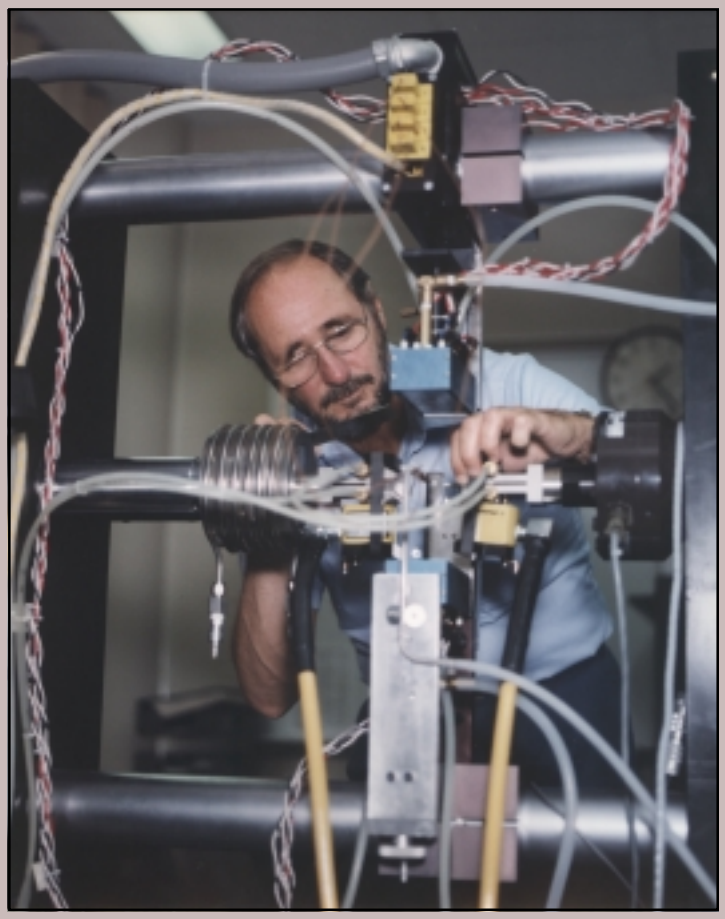
In the near term, the Air Force is faced with the challenge of operating an aging aircraft fleet. As the Air Force's fleet ages, the Air Force will have to deal with the issues of reduced structural integrity, increased maintenance cost burden, and reduced readiness. Materials and manufacturing technologies will be critical to identifying structural integrity and maintenance issues; to assuring improved replacement materials; and to providing remediation and repair materials and processes.

At the same time, to replace this aging fleet, the Air Force is faced with planning the development of the next generation of aircraft in a period of dramatically escalating costs due to technology sophistication. It is vital that more affordable materials and processes be developed to help achieve economic viability of these systems.

The Air Force Research Laboratory has also started migrating its investments towards developing space-specific technologies. The Materials and Manufacturing directorate is leading the way by seeking enabling materials, processes and manufacturing technologies that will help turn those investments into reality.

Materials and manufacturing technologies have had a profound impact on today's Air Force, from lightweight materials for high performance aircraft, to low observable materials for systems invulnerability, to electronic materials enabling pinpoint precision warfare. Among the Directorate's many accomplishments are carbon-carbon composites for high temperature propulsion and re-entry vehicle applications, advanced structural composites, laser-hardened goggles for personnel protection, and nondestructive computer-aided tomography inspection techniques. There is every reason to believe that this is just the beginning of a revolution in the impact that materials will have in the future. There are already indications of a future in which prediction-based computational methods will enable us to design and synthesize materials that will be tailored for specific applications.

Nanophased materials and composite materials will enable integrated sensing, energy conversion, and structural functions.



*CONDUCTING A TEST — Dr. Ted Nicholas, of the Materials and Manufacturing Directorate, removes a test specimen after thermochemical fatique tests on a titanium matrix composite to evaluate its durability for potential turbine engine applications.*

New electromechanical systems will exploit revolutionary multi-functionality for systems at small scale. Materials will enable enhanced opto-electronics and all-optic information gathering, transmission, processing and storage. Processes will exist that will enable aircraft parts to be produced on demand, eliminating the need for large inventories of parts and tooling.

This future is not "pie in the sky," but based upon materials science and technology presently at the fundamental level. The Materials and Manufacturing Directorate's vision is to provide "Materials and Processes to meet the Challenges" of the future. By being materially innovative and assuring a robust research and development capability that proactively influences the development of advanced materials and manufacturing technologies, the directorate keeps the U.S. Air Force the best in the world.

For more information about the Materials and Manufacturing Directorate, please visit the AFRL web site at http://www.afrl.af.mil or the directorate's web site at http://www.ml.afrl.af.mil/. **@**